IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

ATTY.'S DOCKET: JACQUINOT=7

In re Application of:	)	Art Unit: 1765
Eric JACQUINOT et al	)	Examiner: D. Deo
Appln. No.: 09/427,675	)	Washington, D.C.
Date Filed: October 27, 1999	)	April 26, 2004
For: NEW ABRASIVE COMPOSITION FOR THE INTEGRATED...	)	Confirmation No.: 3607

BRIEF ON BEHALF OR APPELLANTS

Mail Stop **Appeal Brief- Patents**
Honorable Commissioner for Patents
U.S. Patent and Trademark Office
2011 South Clark Place
Crystal Plaza Two, Lobby, Room 1B03
Arlington, Virginia 22202

Sir:

The present appeal is taken from the Action of the Examiner in at least twice rejecting claims 17-40. A clean copy of these claims, double spaced, appears in the Appendix to this Brief.

REAL PARTY IN INTEREST

The real party in interest is Clariant (France) S.A. of Puteaux, France.

RELATED APPEALS AND INTERFERENCES

Undersigned is aware of no related Appeals or Interferences.

STATUS OF THE CLAIMS

Claims 1-16 have been cancelled. Claims 17-40 stand rejected.

STATUS OF AMENDMENTS

All amendments have been entered.

SUMMARY OF INVENTION

The present invention relates to a process for mechanical chemical polishing of silicon oxide and/or silicon nitride surfaces, or low dielectric polymer surfaces, wherein an abrasive liquid composition comprising an aqueous acid suspension of (1) individualized colloidal silica particles not linked to each other by siloxane bonds and (2) a surfactant is used. (Specification[1] page 1, numbered lines 6-10; page 6, lines 3-10; claims 17, 37 and 40).

Under preferred conditions of implementation of the invention, the pH of the composition is between 1 and 5, preferably between 2 and 3. (Paragraph spanning pages 6 and 7; claims 20-25 and claims 37-40).

As far as the size of the particles is concerned, a preferred average diameter of the individualized abrasive particles is between 12 and 100 nm, preferably 35 and 50 nm. (page 6, lines 20-22; claims 20-25).

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[1] Unless otherwise indicated, references hereinafter are to Appellants' specification.

As cationic surfactants tend to destabilize the polishing composition, the surfactant is preferably non-ionic or anionic (see page 7, lines 20-26; claims 18 and 19, particularly the latter; claim 38).

As regards the concentration of the silica particles, it is preferably between 25% and 35% (page 7, line 5; claims 28-30). The volumetric concentration of the surfactant in the aqueous suspension is between 0.001% and 5% (page 7, line 14; claims 31-33), and more preferably between 0.001% and 1% (page 7, line 15; claims 34-36).

In the present invention, the use of a surfactant in the aqueous acid suspension allows the polishing speed of the silicon nitride to be reduced very considerably while maintaining the polishing speed of the silicon oxide at a sufficient level. In this regard, Appellants' specification states as follows at page 7, lines 7-11:

> The surfactant used allows the polishing speed of the silicon nitride to be reduced very considerably whilst preserving the polishing speed of the silicon oxide. A selective polishing of the silicon oxide relative to the silicon nitride is thus obtained. It also allows the polishing speed of polymers with a low dielectric constant to be increased very considerably.

A selective polishing of the silicon oxide related to the silicon nitride is thus obtained (please also see example 1, test 4; example 2, test 9; example 11, test 3; and example 13

test 4). As stated above, the use of the surfactant further allows the polishing speed of polymers with a low dielectric constant to be increased very considerably (please also note example 5 of the present specification).

In use, the slurry of the present invention, a liquid composition containing an abrasive as pointed out above, is poured on a rotating pad as noted for example on page 9, line 9, and in Example 1 which shows an abrasive flow rate of 100 cm^3/min.

ISSUES

There is only one main issue, namely whether or not each of Appellants' claims would have been obvious in the sense of §103 from a consideration together of the two cited references, i.e. Jacquinot et al USP 6,043,159 (Jacquinot), and Grover et al., USP 5,799,917 (Grover). There are a number of sub-issues as well including, *inter alia*,

whether or not it would have been obvious to a person of ordinary skill in the art at the time the present invention was made to attempt to combine the two citations, e.g. whether or not the citations provide any motive or incentive, reason or purpose, teaching or suggestion for their combination as proposed;

whether or not Grover teaches away from the present invention or at least away from any combination with Jacquinot;

whether or not any combination of the two citations together would result in the claimed subject matter, even if it were obvious to attempt to combine them; and

whether or not Appellants' improved results could have been predicted or foreseen from the prior art, i.e. whether or not there would have been a reasonable expectation of obtaining Appellants' improved results from a consideration of the citations together.

Other sub-issues will become apparent from Appellants' argument section appearing below.

GROUPING OF CLAIMS

Appellants' claims do not all stand or fall together for the reasons pointed out in the "Argument" section below.

Claims 18 and 19 should be considered separately from claim 17.

For the purpose of confirming that Appellants' "aqueous acid suspension" corresponding to Appellants' "abrasive composition" is a liquid, i.e. a slurry, claims 26-29 (which recite the concentration in the aqueous acid suspension of the silica particles) should be considered in addition to claim 17.

Claims 23 and 24, which recite a pH between 2 and 3, and claims 27 and 28 which depend therefrom, should be considered separately from claim 17.

Claims 37 and 40 should be considered separately from the other claims in that in claim 40 the abrasive liquid composition is substantially free of other components, and in claim 37 the abrasive liquid composition is limited to the presence of the recited essential components.

Otherwise, for purposes of this Appeal, the other claims may be considered together.

Appellants make no admissions that any of the claims are or are not patentably distinct from one another.

ARGUMENT

Appellants' claims stand rejected under 35 U.S.C. 103(a) as being allegedly obvious from a consideration together of Jacquinot and Grover. It is respectfully submitted that Appellants' claimed subject matter would not have been obvious to the person of ordinary skill in the art at the time the present invention was made from a consideration of the two references relied upon.

Appellants believe and respectfully submit that there is nothing in the record to support the Examiner's allegations of obviousness of combining the two citations in any way whatsoever, let alone in a way which corresponds to or

would lead to Appellants' claimed subject matter. Appellants respectfully submit that the only way that the Examiner could have gotten the idea to combine the citations in the way set forth in the rejection was from Appellants' own disclosure, which of course was not available to the person of ordinary skill in the art at the time the present invention was made.

Appellants' invention as claimed would not have been *prima facie* obvious to those of ordinary skill in the art because the prior art provides no motive, no incentive, no reason and no purpose to combine the prior art as proposed, and indeed Grover teaches away from the present invention, and there is no other evidence of the obviousness of doing what the present Appellants did, for reasons pointed out below. The examiner has not met the burden imposed under the law for establishing a *prima facie* case of obviousness.

In addition, the level of improvement achieved by the addition of surfactant to the Jacquinot slurry could not have been predicted or foreseen from either Jacquinot (entirely silent on the use of surfactant) or Grover. In particular, the prior art provides no reasonable expectation of the degree of Appellants' improved results.

I. The Errors in the Rejection

The rejection is erroneous because there is no reasonable teaching in the prior art which would have made it

obvious to modify Jacquinot by adding a surfactant, and particularly only an anionic or non-ionic surfactant, to the abrasive slurry of Jacquinot.

The rejection is erroneous because the Examiner has not pointed out (and cannot point out) why the person of ordinary skill in the art, seeking to solve the problem faced by Appellants, would not simply have followed Grover rather then abstracting a minor and seemingly insignificant material from Grover for incorporation into Jacquinot.

The rejection is erroneous because the improved results obtained by Appellants' process could not have been predicted or foreseen.

The rejection is erroneous because the examiner has not given proper effect to the Declaration under 37 CFR 1.132 of Dr. Jacquinot.

Other errors in the rejection will be apparent from the arguments appearing below.

II. What the Prior Art Discloses

Jacquinot is a patent based on the earlier work of two of the present three Inventor-Appellants, and was granted from an application examined and issued by the present examiner in charge. It discloses a method of chemical mechanical polishing of electric isolation material using an acid aqueous suspension of colloidal silica containing

individualized colloidal silica particles, not linked together by siloxane bonds, and water as the suspension medium. Abrasion is carried out by rubbing the layer in question using a fabric which has been impregnated with the acid aqueous suspension of colloidal silica.

Consistent with the process of the present invention, the particle size of the silica particles is between 3 and 250 nm, preferably between 3 and 150 nm, and most preferably between 10 and 50 nm.

In addition, the pH is between 1 and 6, preferably 1.5-4 and most preferably 2-3.

However, Jacquinot is directed to the chemical mechanical polishing specifically of silicon dioxide layers, and no mention is made of the polishing of silicon nitride, polymers having low dielectric constant, or materials formed of one layer of silicon oxide and another layer of silicon nitride, in which the problems exist which necessitated the present invention.

Most importantly, Jacquinot does not disclose the presence of a surfactant in the liquid abrasive composition which is impregnated into the fabric used for rubbing the surface to be polished.

Unlike Jacquinot, Grover is concerned with the same or similar problems faced by the present Appellants. As

stated in the first paragraph near the top of column 1, Grover indicates that the invention disclosed therein concerns a chemical mechanical polishing (CMP) slurry having "**a unique chemistry that is especially suitable for chemical mechanical planarization where a high silicon dioxide removal rate, and a low silicon nitride removal rate are required on the same substrate.**" Please compare the background section of Grover with the background section of the present application, and also please note the objectives set forth in Grover at column 2, lines 22-31, especially the third such statement as follows:

> …, this invention is a method using a chemical mechanical polishing composition that selectively removes silicon dioxide from a substrate while leaving a silicon nitride layer associated with the substrate essentially intact.

In this regard, the objective and teaching of Grover is to provide a CMP slurry that has a greater than a 5 to 1 oxide to nitride selectivity (column 2, line 8-10). It is the "**unique chemistry**" that achieves Grover's results.

To accomplish its objectives, Grover teaches a method for using a chemical mechanical polishing composition comprising carboxylic acid, a salt and a **soluble cerium compound** in an aqueous solution having a pH above 3, i.e. from about 3.0 to about 11, preferably from about 3.5 to about 6.0, and most preferably about 3.8 to about 5.5 (column 6, lines

31-34), to selectively remove by polishing silicon oxide overfill in preference to a silicon nitride film layer (column 2, lines 47-50).

The chemical mechanical polishing composition may be used alone or it may be combined with a metal oxide abrasive to form a slurry (column 2, lines 61-63). The optional metal oxide (which may or may not be added to the CMP composition) may be selected from the group including alumina, titania, zirconia, germania, silica, ceria and mixtures thereof (column 4, lines 22-24).

In Grover the "unique chemistry" clearly is the composition of carboxylic acid and the soluble cerium compound that provide the selective polishing capability.

In preferred embodiments of Grover in which an abrasive slurry is added to the composition, pulverized cerium oxide (column 4, lines 46-54), precipitated cerium oxide (column 5, lines 3-10) or fumed silica (column 5, lines 11-25) are mentioned as metal oxide abrasives. Discrete metal oxide particles having a particle diameter less than 500 nm are cited (column 5, lines 56-59), but there is no working example and no details are given about the type of discrete particles.

Grover also discloses the optional use of surfactants (column 6, lines 37-64). However, surfactants are only one variety of additional optional additives. Further,

the function of the optional surfactant is stated to be to improve stability of the polishing slurry, i.e. against settling, floccultation and decomposition of the oxidizing agent (column 6, lines 37-39) or to improve steric stabilization of the slurry (column 6, lines 49-54), or possibly to improve the within-wafer-non-uniformity (WIWNU) of the wafers. However, not a single one of the thirty-four (34) specific examples of Grover shows the use of a surfactant in the slurry.

The amount of surfactant used, if any, should be sufficient to achieve effective steric stabilization of the slurry, but no specific amount is disclosed[2]. The surfactant can be anionic, cationic, nonionic, amphoteric, or any combinations of two or more surfactants (column 6, lines 37-54). There is not the faintest hint in Grover that the optional surfactant has any effect whatsoever on selectivity.

Further according to Grover, column 6, lines 21-29, "[c]ommercially available precipitated cerium oxides sold at a pH of about 1.5 are ineffective as CMP slurries". Grover et al say they "have discovered that significantly increasing the pH of the commercially available slurry to about 3.5 results in a CMP slurry that is useful for STI polishing."

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[2] There is a general disclosure at column 6, line 59, of 0.001% to 10%, but this is understood to relate to all additives.

III. Features Recited In Appellants' Claims Which Are Not Made Obvious By The Proposed Combination

As regards claim 17, the prior art does not make obvious the claimed process applied to the specified layer, wherein the specified aqueous acid suspension of colloidal silica particles impregnated within the rubbing support contains "a surfactant", let alone a non-ionic or anionic surfactant as per claim 18, or an anionic surfactant as per claim 19.

With respect to claims 23 and 24 (and the claims which depend therefrom) no prior art discloses or teaches applicants' claimed process wherein the maximum pH of the slurry is 3.0, and indeed Grover expressly states that its CMP slurry must have a pH which is a minimum of 3 and more preferably a pH "from about 3.5 to about 6.0, and most preferably… from about 3.8 to about 5.5" (column 6, lines 30-33), and that commercially available precipitated cerium oxides sold at a pH of about 1.5 are "ineffective" as CPM slurries, but that "significantly increasing the pH of the commercially available slurry to about 3.5 results in a CMP slurry that is useful for STI polishing" (column 6, lines 21-25).

With respect to claim 37, no prior art discloses or makes obvious mechanical chemical polishing using an abrasive

liquid composition which "consists essentially of" the recited components.

With regard to claim 40, no prior art discloses or makes obvious the claimed mechanical chemical polishing using an abrasive liquid composition as claimed which is "substantially free of other components".

IV. There Is No *Prima Facie* Case Of Obviousness

As understood, the Examiner agrees that the present invention defines over Jacquinot in the use of a surfactant in the aqueous acid suspension of colloidal silica particles. As further understood, the Examiner relies on Grover for this lacking in Jacquinot, i.e. the use of a surfactant in a chemical mechanical polishing composition.

The next question then is what the prior art in any reasonable combination teaches those of ordinary skill in the art.

In this regard, and considering the proposed combination, one must first ask what the person having ordinary skill in the art would do, faced with Appellants' problem and reading Jacquinot and Grover together. As Grover seeks to solve the same problems (or similar problems) faced by the Appellants, the person of ordinary skill in the art facing the same problems would be strongly guided by Grover, and less guided by Jacquinot which does not mention those

problems. What then does Grover absolutely require in order to accomplish the objective of greater than a 5 to 1 oxide to nitride selectivity so as to selectively remove silicon dioxide while leaving silicon nitride essentially intact? The answer is clear! **Grover absolutely requires (1) a carboxylic acid, (2) a salt, (3) a soluble cerium compound,** and (4) a higher than previously used pH, preferably at least 3.5. The presence or absence of a surfactant is unimportant in Grover.

The person skilled in the art seeking to obtain the present results would have had no incentive to combine both references (Jacquinot and Grover) together in any way, let alone in the restricted way of the rejection taught only by the Appellants.

To accomplish the desired objectives, the person of ordinary skill in the art is guided by Grover to use a polishing slurry which critically contains a carboxylic acid, a salt, and a soluble cerium compound, and it is stated at the bottom of column 2 that such a composition has "been found to inhibit silicon nitride polishing". Therefore, these ingredients must be incorporated, and their inclusion is contrary to the present invention. In effect, Appellants have flown in the face of Grover and have nevertheless surprisingly achieved success.

By focusing entirely on the optional use of a surfactant in Grover, the examiner has essentially ignored consideration of Grover "as a whole", contrary to what is required when considering prior art under §103. Thus, it is not proper to isolate one element from the teachings of a reference, but the reference in its entirety must be considered, noting for example *In re Mercier*, 185 USPQ 774, 778 (CCPA 1975), where the Court stated:

> Whether Appellant's invention is obvious under 35 USC 103 depends at the outset upon the propriety of the Board's simultaneous reliance on what Enk says is known in the art and disregard the rest of Enk's disclosures. We find several difficulties with this analysis. …. These and other questions arise because the Board's approach fails to recognize that ***all*** of the relevant teachings of the cited references must be considered in determining what they fairly teach to one having ordinary skill in the art. [citations omitted; emphasis of the Court]

The Court then continued further as follows:

> The relevant portions of a reference include not only those teachings which would suggest particular aspects of an invention to one having ordinary skill in the art, but also those teachings which would lead such a person away from the claimed invention. [citation omitted]

Also see *In re Wesslau*, 147 USPQ 391, 393 (CCPA 1965), where the Court stated:

> It is impermissible within the framework of section 103 to pick and choose from any one reference only so much of it as will support

> a given position, to the exclusion of other parts necessary to the full appreciation of what such reference fairly suggests to one of ordinary skill in the art.

Also see *In re Umbricht*, 160 USPQ 15, 19 (CCPA 1968) to the same effect.

Grover teaches those of ordinary skill in the art to proceed in a way which is **different** from and contrary to both the present invention and Jacquinot, and it therefore teaches away from the present invention for the reasons pointed out above. Grover teaches that to obtain Appellants' results, one must use the "unique chemistry" disclosed by Grover, including a soluble cerium compound, but Appellants have flown in the face of Grover by not using a soluble cerium compound, and have achieved success, the very antithesis of obviousness.

Moreover, evidence is also present in Grover which additionally teaches away from the present invention, attention being respectfully invited to slurries 20 and 21 of Table 4, column 9 of Grover.

In these two examples, the quantity of Grover's critical components (in these examples the percentage of ammonium cerium nitrate) was insignificant, but the slurry did contain 4% by weight of silica. The selectivity was very low, under 5. This evidence teaches away from following any teachings of Jacquinot, i.e. proceeding without a significant amount of soluble cerium compound, and thus teaches away from

the proposed combination and from the present invention. Certainly, there would have been no reasonable expectation of Appellants' success from a consideration of slurries 20 and 21 in Table 4 of Grover, and it must be concluded that Appellants' invention would not have been obvious from the prior art.

Bearing in mind that (1) the surfactant of Grover is optional, and (2) is not used in any of the Grover slurry examples, and (3) further in view of the fact that Grover makes no teaching whatsoever that such a surfactant has any ability at all to improve the oxide to nitride selectivity of a CMP slurry, and (4) further bearing in mind that Grover teaches that other components are absolutely necessary to achieve such a result (which components are not used in and are contrary to the present invention), the addition of a surfactant not only would not have been *prima facie* obvious to the person of ordinary skill in the art in order to obtain the desired objective of increasing the oxide to nitride selectivity, but also there is not the remotest hint in the prior art that the addition of a surfactant would provide Appellants' selectivity.

To restate this latter point, the addition of a surfactant to the Jacquinot composition provides unexpected effects, i.e. the selective polishing of silicon oxide

relative to silicon nitride, which could not have been predicted or foreseen from the prior art. The prior art provides no reasonable expectation of improved selectivity by the addition of surfactant to the Jacquinot composition.

Appellants have noted above some fundamental differences between Grover and Jacquinot, even though both deal with chemical mechanical polishing and compositions for use in conjunction therewith. These basic differences mitigate against any reasonable combination of these two prior art citations, which have rather different fundamental requirements.

To briefly reiterate, Jacquinot teaches polishing a layer of isolating material based on silicon or a silicon derivative using a composition comprising an aqueous solution of colloidal silica particles. However, there is no mention in Jacquinot of the polishing of materials formed from one layer of silicon oxide and another layer of silicon nitride, which causes problems which necessitated the present invention.

Unlike Jacquinot, Grover teaches selectively polishing a silicon oxide overfill in preference to a silicon nitride film, the same problem sought to be solved by the present Appellants. Grover discloses using a polishing composition essentially comprising a carboxylic acid, a salt

and a soluble cerium compound at a pH preferably above 3.5. While a surfactant may optionally be present (but none are present in any of the Grover examples), it is not the surfactant in the slurry that provides the selective polishing feature of the Grover composition. The optional surfactant is only suggested, if needed, for one or more of the reasons noted above having nothing to do with improved selectivity.

One issue is whether one skilled in the art would have been motivated to add the optional and presumably not very important surfactant of the Grover composition for selectively polishing silicon oxide over silicon nitride to the slurry of Jacquinot which is used to polish silicon oxide, knowing that the surfactant has no stated usefulness for improving selectivity.

The declaration of Dr. Eric Jacquinot (hereinafter, the Jacquinot declaration) was filed August 1, 2003, and has more than one purpose, one such purpose being to check out the importance of surfactant in Grover. It turns out that the Grover disclosure is correct, i.e. surfactant is relatively unimportant in the Grover "unique chemistry". In this declaration, tests are reported in which a silica slurry such as that disclosed in Jacquinot was formulated with and without a surfactant, and a precipitated cerium nitrate slurry was prepared with and without surfactant. This was done to

comparatively test the effect of surfactants in the two different types of slurries, and particularly to check the accuracy of the Grover disclosure as to the relative unimportance of the surfactant in the Grover slurry.

It is clear from the Jacquinot declaration that the presence of a surfactant in the Jacquinot slurry dramatically improved the polishing selectivity, fully consistent with the present invention. However, the presence of a surfactant in the Grover slurry improved the selectivity of the polishing agent to a much lesser degree. This confirms that there is no practical advantage in adding to the Grover slurry, consistent with what is to be fairly understood from the Grover diclosure.

Table 1 in the Jacquinot declaration makes it quite clear that the selectivity of the silica slurry containing surfactant is increased dramatically over the same slurry without the surfactant. The silica slurry at pH 2.5 without surfactant had a selectivity of 4.4, while the same slurry with 1% or 0.5% by volume surfactant had selectivities of 520 and 313, respectively.

In contrast thereto, the Grover-like ceria slurries at pH 1.8 and 4.2 without surfactant exhibited selectivities of 18 and 50, respectively. The Grover Example 3 slurry had a selectivity of 50 without surfactant, and a selectivity of 135

with surfactant. In fact, according to the Jacquinot declaration, this amounts to little difference between the slurries, because the difference in polishing speed of silicon nitride between the two tests is not a reliable indicator of the advantage of either one because both values are so small that accurate measurements are difficult at best, and the decrease to 2 Angstroms/minute in test 9 provides no evidence of any increase in selectivity.

The Jacquinot declaration demonstrates conclusively to one skilled in the art that there is no meaningful advantage in selectivity to be gained from adding a surfactant to the Grover slurry, while there is a significant gain in selectivity obtained from adding a surfactant to the Jacquinot slurry. Therefore, because adding a surfactant to the Grover slurry makes little difference in selectivity, and involves extra material and processing costs, one skilled in the art would not be motivated to add a surfactant to the Jacquinot slurry.

Table 2 of the Jacquinot declaration shows that the slurries of Jacquinot and those of the present invention exhibited substantially the same stability, whether or not a surfactant was present. However, the slurry of Example 3 of Grover exhibited no increase in stability when a surfactant was added. Therefore, despite the disclosure in Grover that

an optional surfactant adds stability, one skilled in the art, having the information contained in the Jacquinot declaration, would have no motivation to add a surfactant to the Jacquinot slurry even to improve stability.

The question to be resolved then is, what does Grover fairly teach the person of ordinary skill in the art, *i.e.* what is the motivation or incentive it provides.

Stated another way, when patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness (*In re Lee*, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002), citing *McGinley v. Franklin Sports, Inc.* 60 USPQ 2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] reference," a question of fact drawing on the *Graham* factors).

Grover teaches a composition for preferentially polishing a silicon oxide overfill in preference to a silicon nitride film layer. This composition, which is based upon a carboxylic acid and a soluble cerium compound, only optionally contains a surfactant. The Jacquinot declaration provides evidence that the surfactant does not provide additional stability to the Grover composition, and there is no evidence

that the presence of a surfactant in the Grover composition substantially improves its selectivity. It is clear that the selectivity in the Grover composition as taught by Grover, comes from the soluble ceria containing composition, not the surfactant, while in the present invention the surfactant provided unexpectedly superior polishing selectivity.

Returning to *In re Lee, supra*, the Court continued as follows:

> The factual inquiry whether to combine references must be thorough and searching. *Id.* … This precedent has been reinforced in myriad decisions, and cannot be dispensed with, *See, e.g., Brown & Williamson Tobacco Corp. v. Philip Morris, Inc.*, 56 USPQ2d 1456, 1459 (Fed. Cir. 2000). ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an essential component of an obviousness holding'") (quoting *C. R. Bard, Inc. v. M3 Systems, Inc.* 48 USPQ2d (Fed. Cir. 1998)) The Court went on to quote *In re Dembiczak*, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999), "Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references.")

There is a requirement for specificity in combining references, *See, In re Kotzab*, 55 USPQ2d 1313, 1317 (Fed. Cir. 2002)("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed").

There is nothing in Grover that would lead one skilled in the art, seeking the objective of improved selectivity, to add a surfactant to the Jacquinot composition to produce a composition which is useful in selectively polishing silicon oxide over silicon nitride. The compositions of Jacquinot and Grover are very different[3], and the specific problems they seek to solve are different. Grover discloses that improved selectivity is obtained by the use of a soluble cerium compound, not by adding a surfactant to the composition. There is accordingly no reason or purpose given in Grover that would lead one skilled in the art to use a surfactant to provide preferential polishing of silicon dioxide over silicon nitride, because the Grover cerium-based composition is said to be selective for silicon oxide over silicon nitride even without surfactant.

Thus, if one skilled in the art were to look at Jacquinot and Grover together, there would be no motivation to combine the optional surfactant of Grover with the silica-based composition of Jacquinot, because there is no hint that

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[3] In addition to the very fundamental difference in the presence or absence of the soluble cerium compound, the Jacquinot silica-based slurry is operational at a pH of 1 to 5, preferably 2-3, while the Grover slurry is inoperative at pH below 3 and preferably below about 3.5. The Grover slurry can include an optional cationic surfactant, but cationic surfactants tend to destabilize the Jacquinot polishing composition (present specification page 7, lines 20-26). These are clearly two different types of polishing compositions, and one skilled in the art would not look to an optional additive in Grover which is said merely to improve stability to provide increased polishing selectivity in Jacquinot.

the surfactant improves the selectivity of the polishing composition.

The Examiner has not met the burden of establishing a *prima facie* case of obviousness.

V. Appellants' Invention Provides Unexpectedly Improved Results

Jacquinot '159 is clearly the closest prior art as regards Appellants' composition, as it relates to a process similar to that of the present invention, but wherein the abrasive composition contains no surfactant. **There is no doubt whatsoever that addition of a surfactant according to the present invention produces surprisingly improved results, i.e. non-obvious subject matter.** There is nothing in Grover which would have led one to reasonably expect that the addition of a surfactant to the liquid composition of Jacquinot '159 would produce improved selectivity results.

Thus, in the present invention, the use of a surfactant in the aqueous acid suspension allows the polishing speed of the silicon nitride to be reduced very considerably while preserving a sufficiently great polishing speed of the silicon oxide. In this regard, it is again noted that Appellants' specification states as follows at page 7, lines 7-11:

> The surfactant used allows the polishing speed of the silicon nitride to be reduced very considerably whilst preserving the polishing speed of the silicon oxide. A selective polishing of the silicon oxide relative to the silicon nitride is thus obtained. It also allows the polishing speed of polymers with a low dielectric constant to be increased very considerably.

A selective polishing of the silicon oxide related to the silicon nitride is thus obtained; please also see example 1, test 4 (comparative); example 2, test 9 (comparative); example 3, test 11(comparative); example 4, test 13 (comparative).

To further support Appellants' position of the unobviousness of the present invention, a number of tests were conducted under the supervision of Dr. Jacquinot, the first named inventor of the present invention and the first named inventor of the primary reference relied upon, and are set forth in the declaration (copy attached) of Dr. Jacquinot filed with the Reply of July 14, 2003[4]. Dr. Jacquinot is an expert in this art as is evidenced by his experience and the work he has produced in the present field. The test results

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[4] In Paper No. 30, the Office Action of December 22, 2003, the Examiner denigrates Dr. Jacquinot's Declaration, and in effect gives it no weight. What the Examiner means by the statement that "it [the Declaration] refer(s) only to the system described in the above referenced application and not to individual claims of the application" is unclear to Appellants. It is Appellants' position that the Declaration provides **evidence**, and should not be ignored or brushed aside. Appellants also note that the Examiner acknowledges that "the Declaration shows a polishing selectivity… and a more stable slurry…." The Examiner suggests that such improvement is irrelevant because "the claims do not have or include the selectivity nor the slurry stability." The answer of course is that the claims do not need to recite the improved results which are inherently a part of the claimed invention.

as set forth in Tables 1 and 2 speak for themselves. However, one can summarize as follows:

1. Looking at Table 1 and comparing the present invention (slurries 2 and 3) with the primary reference, i.e. Jacquinot (slurry 1), there is a surprisingly high increase in effectiveness by a factor of 119 in slurry 2 over slurry 1, and an increase by a factor of 49 of slurry 3 over slurry 1.

2. The present invention also provides substantial improvements over Grover, or even over Grover modified to make it more like the present invention.

3. With regard to stability as shown in Table 2, the Grover slurry 8 is unstable. The addition of surfactant does not improve its stability as noted from test 9.

4. Better selectivity results are obtained according to Grover at higher pH (slurry 8 compared with slurry 6), consistent with what is disclosed in Grover. On the other hand, as noted above, when the pH of the Grover is increased, the slurry becomes unstable.

Appellants also request consideration of the conclusions of Dr. Jacquinot commencing at the bottom of page 8 of the attached Declaration. Dr. Jacquinot's conclusions will not be here repeated, as they already appear in the declaration. These conclusions include statements of fact, which must be accepted. To the extent that they include

opinions, it is noted that Dr. Jacquinot is an expert in this art and his expert opinion must also be given weight.

For further evidence of selective polishing of silicon oxide relative to silicon nitride according to the present invention, the Jacquinot declaration clearly demonstrates that a colloidal silica slurry to which a surfactant is added is far more selective than the same slurry without a surfactant. This was not at all true for the cerium containing slurry of Grover. Thus, the degree of the improvement according to the present invention is very surprising.

As stated above, the use of the surfactant according to the present invention further allows the polishing speed of polymers with a low dielectric constant to be increased very considerably (please also note example 5 of the present specification).

Accordingly, it surprisingly turns out that the presence of a surfactant as part of the liquid polishing composition very substantially increases the polishing performance, a result which could not have been reasonably expected from a consideration of the cited prior art, and

certainly not a result which could have been predicted or foreseen.[5]

Appellants respectfully submit that even if it were to be considered that Grover fairly suggests to one skilled in the art that some benefit is to be achieved by adding a surfactant to the liquid composition of Jacquinot, contrary to Appellants' position, this **still** does not teach the present invention, because that does not take into account the unobvious improved results achieved according to the present invention as alleged in Appellants' presumptively accurate disclosure and as shown in the comparative data present in the Examples of Appellants' specification and in the Jacquinot declaration. Appellants respectfully repeat that the prior art provides no reasonable expectation of the improved polishing achieved according to the present invention.

CONCLUSION

Appellants respectfully submit that the Examiner's combination rejection is unreasonable, that no *prima facie* case of obviousness has been established, and therefore the Examiner has not met the burden imposed by the law.

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[5] In the Reply to the first final Action, Appellants asked the Examiner, if the Examiner disagreed, "to point out where in the references there is any suggestion, any teachings or even the remotest inference that adding a surfactant to a liquid polishing composition would improve the results as are achieved according to the present invention." The Examiner did not answer.

The prior art provides no meaningful incentive or motive for adding a surfactant to the composition of Jacquinot. To add another ingredient without achieving the desired benefit would merely add to the cost, clearly an undesirable option. But Appellants have surprisingly found that the use of a surfactant provides unexpected polishing benefits as set forth in Appellants' specification. Certainly this is unobvious.

The real teaching of Grover is that if one wants to improve selectivity, one must use a soluble cerium compound. This is not what the Appellants' did. The Appellants did something else, i.e. they added a surfactant to the composition of Jacquinot, an expedient which the prior art provides not the faintest suggestion or even hint would provide any improved selectivity, but this simple expedient did unobviously produce vastly improved selectivity.

The rejection should be reversed and such is respectfully prayed.

Respectfully submitted,

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APPENDIX

17. A process for mechanical chemical polishing in the integrated circuits industry, comprising

rubbing a layer with a support impregnated with an abrasive composition, wherein

said layer is (1) a material selected from the group consisting of silicon oxide, silicon nitride, and a polymer having a low dielectric constant, or (2) one layer of silicon oxide and another layer of silicon nitride, and

said abrasive composition comprises an aqueous acid suspension of

(i) individualized colloidal silica particles not linked to each other by siloxane bonds,

together with (ii) a surfactant, and

wherein said abrasive liquid composition is at a pH of 1-5.

18. The process of claim 17, wherein said surfactant is an anionic or non-ionic surfactant.

19. The process of claim 18, wherein said surfactant is anionic.

20. The process of claim 19, wherein said rubbing is carried out with said individualized colloidal silica particles have diameters between 12 nm and 100 nm.

21. The process of claim 18, wherein said rubbing is carried out with said individualized colloidal silica particles have diameters between 12 nm and 100 nm.

22. The process of claim 17, wherein said rubbing is carried out with said individualized colloidal silica particles have diameters between 12 nm and 100 nm.

23. The process of claim 22, wherein said pH is between 2 and 3, and

said particle size is between 35 and 50 nm.

24. The process of claim 21, wherein said pH is between 2 and 3, and

said particle size is between 35 and 50 nm.

25. The process of claim 20, wherein said pH is between 2 and 3, and

said particle size is between 35 and 50 nm.

26. The process of claim 25, wherein the concentration by weight of said individualized colloidal silica particles is between 25 and 35 % in said aqueous acid suspension.

27. The process of claim 24, wherein the concentration by weight of said individualized colloidal silica particles is between 25 and 35 % in said aqueous acid suspension.

28. The process of claim 23, wherein the concentration by weight of said individualized colloidal silica particles is between 25 and 35 % in said aqueous acid suspension.

29. The process of claim 22, wherein the concentration by weight of said individualized colloidal silica particles is between 25 and 35 % in said aqueous acid suspension.

30. The process of claim 21, wherein the concentration by weight of said individualized colloidal silica particles is between 25 and 35 % in said aqueous acid suspension.

31. The process of claim 18 wherein the volumetric concentration of said surfactant is between 0.001% and 5%.

32. The process of claim 20 wherein the volumetric concentration of said surfactant is between 0.001% and 5%.

33. The process of claim 25 wherein the volumetric concentration of said surfactant is between 0.001% and 5%.

34. The process of claim 18, wherein the volumetric concentration of said surfactant is between 0.01% and 1%.

35. The process of claim 22, wherein the volumetric concentration of said surfactant is between 0.01% and 1%.

36. The process of claim 26, wherein the volumetric concentration of said surfactant is between 0.01% and 1%.

37. A process for mechanical chemical polishing in the integrated circuits industry, comprising

rubbing a layer with a support impregnated with an abrasive liquid composition, wherein

said layer is (1) a material selected from the group consisting of silicon oxide, silicon nitride, and a polymer having a low dielectric constant, or (2) one layer of silicon oxide and another layer of silicon nitride, and

said abrasive liquid composition consists essentially of an aqueous acid suspension of

(i) individualized colloidal silica particles not linked to each other by siloxane bonds,

together with (ii) a surfactant, and

wherein said abrasive liquid composition is at a pH of 1-5.

38. The process of claim 37, wherein said surfactant is an anionic or non-ionic surfactant.

39. The process of claim 37, wherein the pH is between 2 and 3.

40. A process for mechanical chemical polishing in the integrated circuits industry, comprising

rubbing a layer with a support impregnated with an abrasive liquid composition, wherein

said layer comprises one layer of silicon oxide and another layer of silicon nitride, and

said abrasive liquid composition is an aqueous acid suspension, having a pH of 1-5, of

(i) individualized colloidal silica particles not linked to each other by siloxane bonds,

together with (ii) a surfactant,

wherein said abrasive liquid composition is substantially free of other components.